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THE METHOD OF D-DEMARCATION FOR THE ANALYSIS OF CONTROL SYSTEMS

/Comment: The method of D-demarcation was first described by Yu. I. Neymark in a paper, "Determining the Values of the Parameters for Which an Automatic Control System Will Be Stable," which appeared in Avtomatika i Telemekhanika, Vol IX, No 3, 1948. Popovskiy's paper contains an extension of Neymark's method to several interrelated variables and, in addition, a concise summary of the method itself. The latter should be of interest to those concerned with the analysis of servomechanism performance._7

The method of D-demarcation has been widely used in the study and construction of control systems and servomechanisms. In this method, the determination of the region of parameters for which a control system either will be stable or will attain a certain degree of stability is broken up into two steps. In the first step, one finds those values of the parameters for which the root of the corresponding characteristic equation lies either on the imaginary axis or on a straight line which is parallel to the imaginary axis at a distance $\mathcal{E}$. The second step lies in the isolation, according to definite rules, of the region of stability (D-demarcation) or of the region of a certain degree of stability ($L_{\mathcal{E}}$ -demarcation). The first problem is solved analytically by substituting $D = j\omega$ or $D = -\mathcal{E} + j\omega$ into the operator equation of the system under consideration.

The use of an analytical method for establishing D-demarcation requires very cumbersome calculations in the case of systems for controlling several interrelated quantities (particularly when these systems contain loops with distributed parameters). Systems for controlling several interrelated quantities, even when idealized, are described by differential equations of a very high order. The derivations of the characteristic equations, the equations for determining the desired parameters of the regulators, and the numerical calculations become very difficult, particularly for the case of $D_{\mathcal{E}}$ -demarcation.